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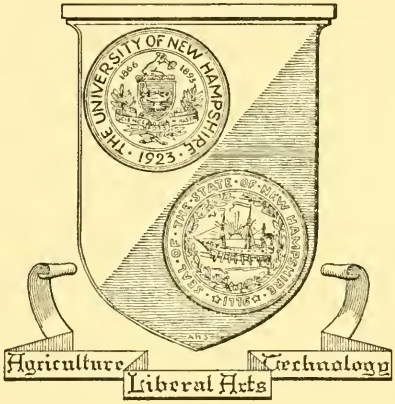

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Bulletin 291 March, 1936

MAINTENANCE OF GRADE A MILK

By E. H. RINEAR and H. C. MOORE

A Study of the Factors Affecting Quality, Returns and Premium Losses

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SUMMARY

1. A study was made of the factors which affect the quality of Grade A milk and the premiums paid to producers of Pattee Station at West Canaan, N. H.

2. In summer fewer Grade A producers keep their bacteria counts under 10,000 than at any other time of year. Premium rates are the highest during the summer months. (See Figure 1 and Table 1.)

3. The amount of milk on which premiums were paid declined from 5,412,877 pounds in 1931 to 5,178,157 pounds in 1932, and to 3,683,447 pounds in 1933. The premiums paid totaled $18,478.50 in 1931, $19,199.23 in 1932, and $13,780.56 in 1933. These premiums represented from 12 to 14 per cent of the gross milk receipts. The average premium paid Grade A producers ranged from $196.58 in 1931 to $142.07 in 1933. (See Table 3.)

4. Very little correlation was found between the dairy scores made by the milk inspector for the Boston Board of Health and the bacteria counts of the same Grade A producers. (See Figure 2.)

5. Loss of premiums was traced to lack of sterilizing the equipment for 38 per cent of those having high bacteria counts. The other principal factors were: poor cooling, 20 per cent; gargety milk, 21 per cent; and labor problems, 13 per cent. (See Table 4.)

6. The above-mentioned factors caused bacteria counts ranging from 25,000 to 810,000 during the three-year period. (See Table 5.)

7. Considerable improvement was made in the control of these factors. Less than half as many reported trouble from improper sterilizing in 1933 as in 1931. There was a steady decline in the number having cooling trouble, chiefly because they had installed cork-insulated tanks. On the other hand, there was a definite increase during the three-year period in the number having trouble with gargety milk. (See Table 4.)

8. The most important single factors in the total lost premium account for the three-year period were: sterilizing, $1,542.18; cooling, $331.74; and gargety milk, $290.86. On a combination basis, sterilizing, unreliable hired help and milking too soon after freshening were the most costly, amounting to $1,380.22. (See Table 6.)

9. When the Grade A producers are compared with Grade B producers, the most important differences are found in the milking practices, the washing and sterilizing of equipment, the amount of ice used, and the time used by Grade A producers in sterilizing. So far as the extra costs are concerned between the two groups they are not important. As a class the Grade A producers look after the details regularly, morning and evening, which will insure milk of high quality. (See Tables 7, 8, 9 and 10.)

MAINTENANCE OF GRADE A MILK

A Study of the Factors Affecting Quality, Returns and Premium Losses*

By E. H. RINEAR, Research Specialist in Marketing, and
H. C. MOORE, Assistant Dairy Husbandman

Grade A milk is being produced and sold quite generally throughout the State. There are four wholesale Grade A receiving stations and eight local markets where Grade A milk is sold in New Hampshire. The factors which cause the loss of Grade A premiums are, therefore, of considerable importance to the dairymen.

The quality of the milk supply is dependent to a large extent upon the care it receives before it leaves the farm. In this study the milk marketing functions are considered from the time the milk is drawn until it is delivered to the receiving station. The effectiveness of the dairyman's methods in handling and caring for Grade A milk determines whether or not first premiums are paid.

There is a definite trend toward more uniform regulation and standardization of all milk shipped into consuming centers. Under these conditions, all dairymen are interested in controlling the factors which affect the quality of milk, whether Grade A or B.

Method and Procedure

Survey records were obtained through personal interviews with 82 Grade A and 20 Grade B producers shipping milk to Boston through the Pattee receiving station at West Canaan, N. H. Detailed information regarding stable, milkhouse, milking and cooling practices, sterilizing equipment, current expense and labor was collected through these contacts. Comparative analysis of these records showed few differences existing in the majority of cases between the A and B shippers at this station. The influence of the quality program and resulting premiums paid had caused the B producers to exercise about the same care in handling milk. Also, most of the B producers were anxious to be shifted over to A grade. It was, therefore, necessary to survey some other section which was not subjected so strongly to the Grade A influence, and which might be used as a basis of comparison. Consequently records were obtained from 24 producers in Monroe, N. H., as only B Grade milk was being shipped from this area.

Many producers were unable to understand why they had low counts one day and high counts on another. The Experiment Station endeavored to solve this problem by working with them, observing the milking practices, the cooling of the milk, and the washing and sterilizing of the equipment. Samples of milk were taken from the cows, milking pails and milk cans during evening and morning milkings, just before the cans were loaded onto the truck and when they were emptied at the station. The condition of the equipment and cans was checked by using sterile water and taking samples before each milking period. All samples were identified by num-

* The writers wish to express their appreciation of the coöperation given by the dairymen, by the officials of H. P. Hood and Company, and by Mr. Ralph C. Downie, former manager of the Grade A Station at West Canaan, N. H.

bers, packed in an iced container and sent to the dairy laboratory in Durham for the bacterial analysis. Carbon copies of the bacteria counts obtained from the samples were given to each producer. The results of the checking were carefully reviewed with him. In this way many of the factors were eliminated which had caused the loss of premiums in the past. This checking of individual producers was made during fall and winter months as well as during the summer. An effort was made to obtain the coöperation of the best producers who seldom had trouble in producing high quality milk for comparison with those who had experienced difficulty. Through the coöperation of officials of H. P. Hood and Company, records were made available for each Grade A producer showing on a 15-day basis during the years 1931, 1932, and 1933, the pounds of milk shipped, price and premiums paid per cwt. and deductions and net amount paid the producer. They supplied copies of the scores of the Boston Board of Health for the Grade A producers at Pattee as well as other statistical information showing the percentage of the producers who received first, second, and third premiums in comparison with their three other Grade A stations.

History of Region and Station

The Pattee receiving station, which was selected for the basis of this study, was built in 1924 and given Grade A rating soon afterwards. Milk was shipped in cans to Boston until 1929. Since then a tank car equipped with A and B tanks has been used.

The principal reason given by the authorities for selecting Pattee as a Grade A station is that milk of high quality had always been shipped from this area. This statement was also verified by the producers. Many stated that they were following about the same practices in caring for the milk now that they did before they were paid Grade A premiums.

Capacity of the station with present equipment is 40,000 pounds daily, which is considerably less than the total capacity of a tank car. About the same amount of milk is received now as ten years ago. The daily average of milk shipped during the year is over 18,000 pounds of Grade A and about 10,000 pounds of Grade B.

Milk is trucked to the Pattee Station from approximately 40 miles. There are five large trucks carrying it from the more distant sections. The longest route extends as far west as Strafford, Vermont. The majority of the producers living within one or two miles of the station do their own trucking. In a few instances neighbors take turns carrying the milk.

Samples were usually taken by the company twice a week from one can as the milk was emptied into the weighing tank. These samples were packed in ice and shipped to the laboratory in Boston. A report of the bacteria counts for each producer's samples was sent out from the Boston office at the end of each 15-day pay period. Each man compared his record with his neighbor's. During the 15-day pay period the manager of the station received reports on each set of samples a few hours after they were available. If the shippers had one or more high counts he immediately visited them and helped to locate and to correct the trouble. In this way the quality of the milk was maintained, and the farmer did not lose his Grade A premiums.

Sediments tests were run periodically on the milk of all producers. The disc showing the amount of sediment was graded as "good," "fair" or "dirty" and was returned to each producer.

The need for insulated tanks to cool milk properly and more efficiently was so great that the manager obtained cork by the carload and sold it to the farmers at about cost. Demonstrations of the proper way to build a tank were made throughout the territory.

Premium Schedule

Premiums were paid Grade A producers according to the quality of the milk as shown principally by bacteria count. Four samples of milk were taken at the station during the 15-day period for each producer. The average of these samples determined whether or not first, second, or third premiums were paid. During the years 1931 and 1932, first premiums were paid when the average bacteria count of these samples was under 10,000 per ml., second premiums when they averaged between 10,000 and 20,000, and third premiums when they averaged between 20,000 and 30,000. In 1933 the third premium was dropped entirely because the larger share of the shippers seldom had counts which averaged over 25,000. The second premium was accordingly paid when the average count was between 10,000 and 25,000. The premium rates varied on a seasonal basis, as shown in Table 1.

TABLE 1

*Schedule of premiums paid Grade A producers during the years 1931, 1932, and 1933**

Months	1st Prem. Under 10,000 b. per ml. Cts. per cwt.	2nd Prem. 10,000 to 20,000 b. per ml. Cts. per cwt.	3rd Prem. 20,000 to 30,000 b. per ml. Cts. per cwt.
January	33	23	18
February	33	23	18
March	33	23	18
April	33	23	18
May	33	23	18
June	53	43	38
July	58	48	43
August	58	48	43
September	53	43	38
October	33	23	18
November	33	23	18
December	33	23	18

From Jan. 1, 1931, to Sept. 1, 1932, premiums were paid on 100% of Class I ratings
From Sept. 1, 1932, to Jan. 1, 1933, premiums were paid on 85% of Class I ratings
From Jan. 1, 1933, to Jan. 1, 1934, premiums were paid on 75% of Class I ratings

The primary objective of the study was to find out what factors cause high and low bacteria counts and also to determine whether or not the premium rates are high enough to cover the costs to the dairymen in producing Grade A milk.

During the three-year period under discussion, numerous demand and supply factors caused a decrease in the total premiums returned. Many consumers could not afford to pay the extra cost of Grade A milk and shifted from purchasing A to B grade or regular milk.** At the same time

** The Consumption of Milk and Dairy Products in Metropolitan Boston in December, 1930. New England Research Council on Marketing and Food Supply.
* In 1933 the third premium was omitted entirely.

producers were improving their methods, and the volume of Grade A milk was gradually increasing. But the quality of B milk was greatly improved. Consequently there was not much apparent difference to the consumer between the two classes. Because of these conditions and the lessened demand, the basis of Grade A was cut from 100 per cent of Class I ratings during the period to 85 per cent and still lower to 75 per cent, as shown in Table 1.

Grade A Standing

A wide seasonal fluctuation occurred in the percentage of producers who kept their bacteria counts under 10,000. (See Figure 1.) This fluctuation was in direct correlation with the premium rates paid. For illustration, in 1931 the highest premium rates were paid in June, July, August, and September, when the smallest percentage of the producers was able to keep their counts under 10,000. In 1932 there was a seasonal drop in June, August, and September, but not in July and the first part of August. In 1933 the decline occurs in July, August, and September. Expressed on a percentage basis for June, July, August, and September, only 41.5 per cent had counts averaging 10,000 in 1931, 67.1 per cent in 1932, and 60.9 per cent in 1933. The better showing made in July and August of 1932 was without doubt due to a better understanding on the part of the producers of the factors causing bacterial growth and of better methods of control. The tendency for the percentage of low counts to taper off during the summer months may be partly due to the lessening of the farm ice supply and the practice of drying off cows previous to establishing a base rating during the fall months.

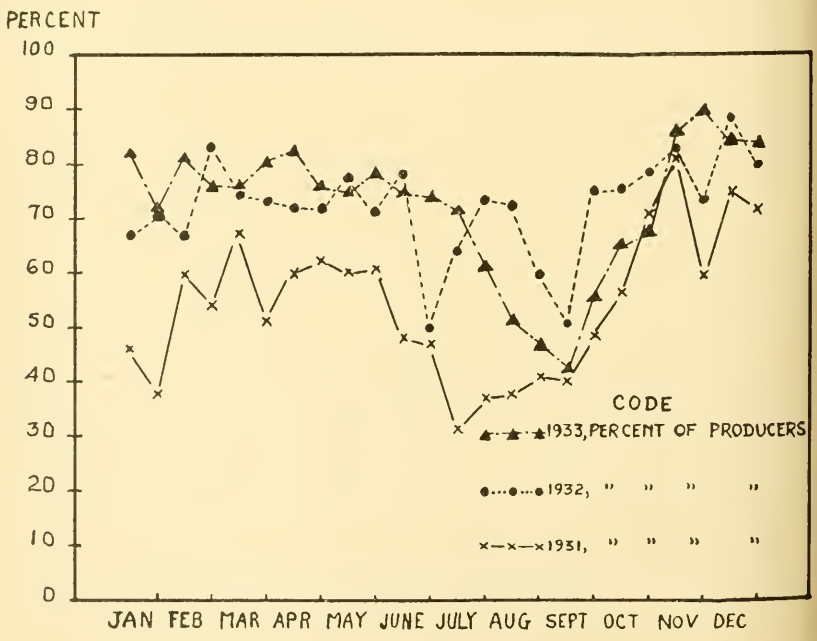

Figure 1. Comparison of the per cent of Grade A producers whose counts averaged under 10,000 for each pay period during the years 1931, 1932, and 1933.

The best records in the control of quality in milk were made in November and December. During these months first premiums were obtained by 71 per cent of the producers in 1931, 82 per cent in 1932, and 87 per cent in 1933.

Attention is called to the fact that the producers made the poorest showing throughout the entire year 1931. In fact, they did about as poorly in the cold winter month of January as during the summer months. The number of Grade A producers who received first premiums improved in 1932, following the testing work done by the Experiment Station. This work started October 6, 1931, and continued into the winter. It was repeated during July, August, and September of 1932. In all, 41 fall and winter dairies were carefully studied and checked; also 30 summer dairies. An attempt was made to select producers who had excellent quality records as well as those who were having trouble. They were well distributed throughout the whole section. The effect of this work undoubtedly helped the dairymen to locate their trouble.

The average bacterial counts on the milk samples taken under fall-winter and spring-summer conditions on the Grade A farms are given in Table 2. The results on the first and second streams show the value of discarding these where high quality milk is produced. The bacterial counts on these streams were much higher when the cows were in the barn than when outdoors. Some of the cows' samples averaged in this table were proven in the laboratory to have garget. If the bacterial count of the milk in the cans is taken as 100%, the P. M. samples under fall-winter conditions increased only 8% by the next morning, while under spring-summer conditions the increase was 20%, showing that the cooling job was not done so well during the warm weather.

TABLE 2

Difference between the average bacterial counts on the milk samples taken under Fall-Winter and Spring-Summer conditions

Milk Samples Taken	Fall–Winter		Spring–Summer	
	Bacteria per ml. P. M.	Bacteria per ml. A. M.	Bacteria per ml. P. M.	Bacteria per ml. A. M.
First streams	33,473	12,552	9,145	11,738
Second streams	5,753	4,986	4,106	4,792
Pails from cows	3,197	3,774	2,569	2,832
Cans in evenings	3,679	.....	2,547	.....
Cans before leaving farm	3,994	5,420	3,060	4,352
Cans at station	6,779	9,144	4,352	6,868

The average bacterial counts on the P.M. samples were lower when delivered at the receiving station, under both fall-winter and spring-summer conditions. This condition was due mainly to the fact that the counts on the cans when filled were much lower on the P. M. samples than on the A. M. samples, showing that the utensils were not cleaned and sterilized so thoroughly in the evening. The increase in the bacterial count during transportation was slightly higher under the fall-winter conditions. The main cause for this was that the milk was on the road longer and in some cases was several hours older when delivered. In a few cases the temperature increase in this milk during transportation was several degrees, but in the majority of cases this increase was not over 2°F.

The checking of milk cans showed that they were not being sterilized sufficiently at the receiving station. The steam pressure at the station was immediately increased from around 40 pounds to 60 pounds maximum. A drop in the number of can counts followed at once; the steam pressure was then increased to 80 pounds maximum on January 1, 1932, and to 100 pounds maximum pressure April 1, 1932. On June 15, 1933, a new 20 h.p. boiler replaced the old 15 h.p. boiler, and the steam pressure was run continuously at 100 pounds maximum. It was further found that when the can washer was run in fast speed and the steam pressure was low the milk cans were not sterilized enough. Eventually the machine was set in low speed so that it required three minutes for a can to pass through. This longer period of sterilizing combined with twice the amount of steam pressure reduced the number of bacteria found thereafter in milk cans to a negligible amount. In fact, several cans were checked and found to be completely sterile.

When Pattee station is compared with three other Grade A stations, namely, those at North Haverhill, N. H., Lancaster, N. H., and Shelburne Falls, Mass., the improvement in the quality program made by the producers of this station is most striking. In 1931 the producers of Pattee were in first place only five times compared with 19 times in 1932 out of a possible 24 times. The average percentage of Pattee producers under 10,000 bacteria counts during the 24-pay periods was only 54.7 per cent in 1931. In 1932 this average percentage had increased to 73.4 per cent. On the other hand, the average percentage of producers with counts under 10,000 at Lancaster, North Haverhill, and Shelburne Falls in 1931 was 62.1 per cent, 56.9 per cent, and 50.4 per cent respectively, and in 1932, it was 62.9 per cent, 58.5 per cent, and 63.4 per cent respectively. Pattee producers improved their counts about 19 per cent, Shelburne Falls producers about 13 per cent, and Lancaster and North Haverhill stations remained practically the same.

During the three-year period the amount of milk on which premiums were paid to the Pattee producers declined from 5,412,877 pounds in 1931, to 5,178,157 pounds in 19232, and to 3,683,447 pounds in 1933. (See Table 3.) The average premium rate per cwt. was 34 cents in 1931, 38 cents in 1932, and 37 cents in 1933. The total premiums paid in 1931 represented over 12 per cent of the gross milk receipts, in 1932 over 14 per cent, and in 1933 over 12 per cent of the gross milk receipts.

There were about the same number of Grade A shippers during the three years. According to the records, the number ranged from 88 to 100 and averaged 94 in 1931, from 93 to 107 with an average of 98 in 1932, and from 88 to 118 with an average of 98 in 1933. On this basis the average amount of premium paid producers was $196.58 in 1931, $195.91 in 1932, and $142.07 in 1933.

Boston Board of Health Scores

About 31 of the Grade A dairies at Pattee were inspected by the representative of the Boston Board of Health during 1932. Each dairy was scored by the inspector according to recognized standards so as to insure the quality of the milk supply. One dairy was scored at 54.3, three from 60 to 70, 19 from 70 to 75, and eight from 75 to 80. The one which scored below 60 was temporarily disqualified until certain conditions were corrected as outlined by the health inspector. These inspections were made during 1932—the majority of them during the fall months.

When a scatter diagram (see Figure 2) is made of all the bacteria

TABLE 3

Total premiums paid Grade A producers at Pattee on a monthly and yearly basis

Year and month	Milk basis for premiums	Total premiums paid	Average premium rate per cwt.	Gross value milk and premiums	Per cent of gross value represented by premiums
1931	(pounds)	(dollars)	(cents)	(dollars)	(per cent)
January	501,061	1,312.93	26	15,941.14	8.2
February	468,253	1,285.26	27	12,212.45	10.5
March	502,566	1,390.15	28	12,912.29	10.8
April	472,215	1,324.52	28	11,975.75	11.1
May	444,990	1,230.80	28	11,351.57	10.8
June	398,819	1,859.07	47	10,893.55	17.1
July	365,257	1,845.45	50	9,630.81	19.2
August	413,731	2,111.59	49	12,820.85	16.5
September	437,972	2,027.33	46	14,184.98	14.3
October	432,924	1,254.71	29	14,179.97	8.9
November	479,325	1,392.41	29	14,209.29	9.8
December	495,764	1,444.28	29	11,608.79	12.4
Total	5,412,877	18,478.50	34	151,921.44	12.2
Av. for 94 producers	57,583	196.58		2.81	
1932					
January	497,355	1,455.05	29	10,523.16	13.8
February	463,383	1,413.62	30	9,703.70	14.6
March	470,574	1,376.90	29	9,733.75	14.1
April	432,030	1,278.75	30	9,026.41	14.2
May	444,359	1,370.06	31	10,192.08	13.4
June	458,001	2,270.73	50	10,264.03	22.1
July	415,316	2,259.65	54	10,512.02	21.5
August	419,081	2,262.20	54	11,743.63	19.3
September	381,045	1,879.69	49	12,438.32	15.1
October	401,358	1,210.76	30	12,639.64	9.6
November	388,985	1,164.55	30	12,042.45	9.7
December	406,670	1,257.27	31	12,954.42	9.7
Total	5,178,157	19,199.23	38	131,773.61	14.6
Av. for 98 producers	52,838	195.91		2.65	
1933					
January	356,645	1,074.76	30	10,994.61	9.8
February	314,982	960.03	30	7,639.20	12.6
March	348,008	1,084.02	31	8,315.99	13.0
April	313,074	965.43	31	7,426.35	13.0
May	312,076	976.14	31	7,652.88	12.8
June	297,993	1,539.92	52	9,095.48	16.9
July	267,418	1,486.21	56	8,139.76	18.3
August	248,339	1,352.07	54	8,643.78	15.6
September	268,094	1,326.17	49	9,192.75	14.4
October	312,176	962.58	31	10,058.44	9.6
November	329,329	1,054.22	32	11,628.34	9.1
December	315,313	999.01	32	10,698.33	8.5
Total	3,683,447 (pounds 32% less)	13,780.56 (paid 27½% less)	37	109,485.91	12.6
Av. for 97 producers	37,974	142.07		2.97	

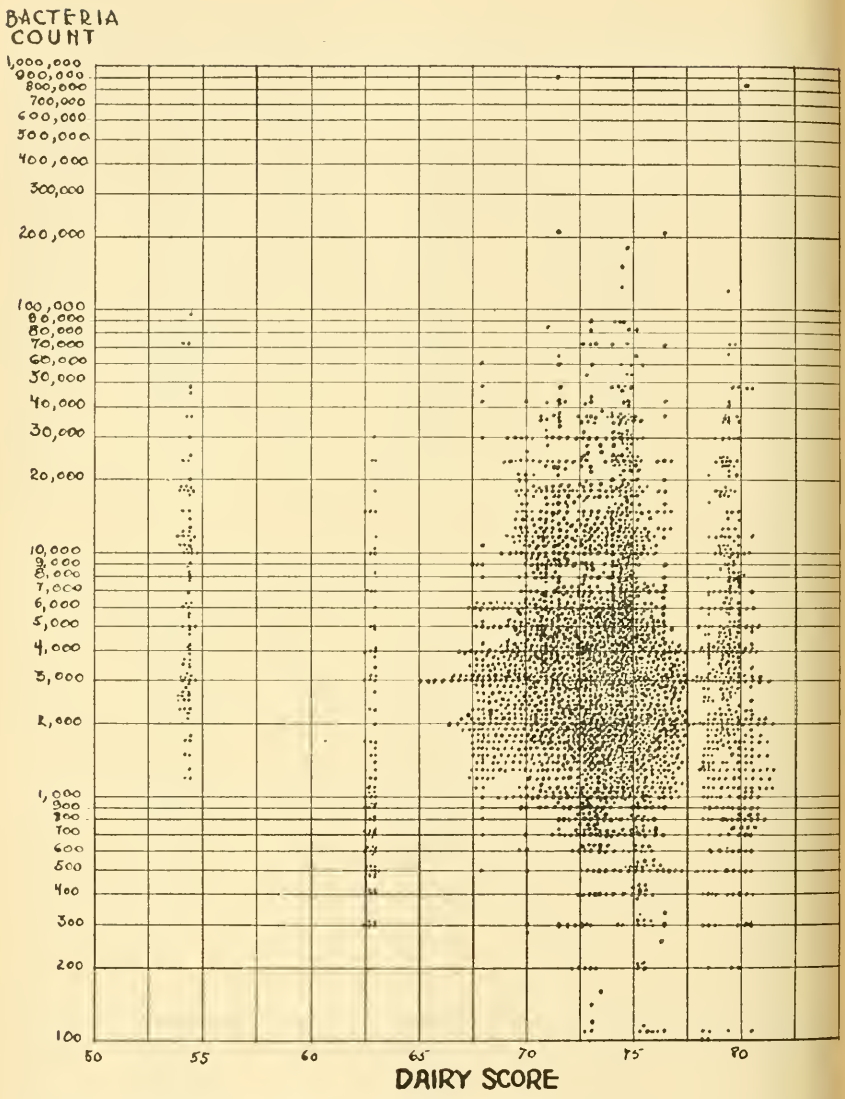

Figure 2. The above scatter diagram of bacteria counts shows the proportional distribution of these counts according to the scores given thirty-one dairymen by the inspector for the Boston Board of Health during 1932. Apparently there is very little correlation between these scores and bacteria counts, for a low or a high count is just as likely to occur with a low as with a high score.

counts for these 31 dairies in relation to the inspector's scores, it shows very little correlation between the bacteria counts and the scores. Apparently a dairy with a low score was almost as likely to have bacteria counts under 10,000 as one with a high score.

The score-card used by the Boston Board of Health is approved by the U. S. Bureau of Animal Industry. A perfect score of 40 points is allowed on equipment and one of 60 points on methods. In fixing the points allowed under these two principal headings, the inspector is given considerable leeway. If the water supply was poor or if there was evidence of the presence of dangerous disease in animals or attendants, the score would be 0. Frequently an inspector had to score a dairy severely in order to have objectionable features corrected. Under these various circumstances it is to be expected that the final scores would vary widely. However, it seems apparent from this scatter diagram that the factors which may cause high bacteria counts should be weighted and scored on a different basis.

Principal Factors Causing High Counts

A careful study was made of each Grade A producer's counts during the three-year period. It frequently happened that a high count of 25,000 occurred along with three low ones so that the average for the 15-day period was under 10,000, thereby allowing first premiums to be paid. Other producers might have many high counts continuously for several pay periods so that they got second or third premiums, or perhaps the average ran over 50,000 for the pay period so that no premiums were paid.

The dairymen were naturally interested in knowing what caused these high counts and how they could be controlled. Through personal contacts with them in coöperation with the manager of Pattee Station a long list of factors and causes was detected regarding the high counts. The fact that on only six per cent of the farms some reason could not be found shows how carefully the situation was studied. (See Table 4.)

By far the greatest number of producers were having trouble in sterilizing their equipment. Fifty-seven did not sterilize properly in 1931, twenty-five in 1932, and twenty-nine in 1933. The equipment itself was the principal factor contributing toward high bacterial growth. Other reasons mentioned were milking machine not washed thoroughly previous to sterilizing, lack of the proper equipment to sterilize, old broken and porous rubber in use on milking machine which was practically impossible to sterilize, the use of old-fashioned eight-quart cans in coolings, which had rough seams of solder and exposed wooden plugs, and milk cans which were dirty or had broken seams. In all 38 per cent of the producers blamed their high counts on improper sterilizing.

On a seasonal basis, lack of sterilizing caused high counts for more producers during the summer months than at any other time of the year. During July, August, and September over 52 per cent of them reported trouble from this factor. More failed to sterilize properly during September than any other month. The best record was made in December, when only two producers experienced high counts from improper sterilizing.

In making the survey of the 82 Grade A producers, information was obtained as to their methods and practices in caring for the equipment and handling the milk. After all, it is just as important to report the practices which have worked out satisfactorily on the farm as it is to point out those which have failed.

Table 4

Principal factors causing high bacteria counts and distribution of Grade A producers during 1931, 1932, 1933

Factors causing high bacteria counts	No. producers affected 1931	1932	1933	Ave. per cent
Sterilizing and Equipment—				
Improper methods	57	25	29	
Milking machine not washed	4	2	2	
Lack of equipment to sterilize	3	1	..	
Broken and porous rubber	2	1	..	
Wooden plugs in 8-qt. cans	1	1	1	
Milk can, dirty, broken seam	..	..	2	
Total	67	30	34	38%
Cooling milk—				
Too slow in cooling below 60°	12	9	7	
Tank too small or leaked	5	4	4	
Lack of ice in tank	4	2	1	
Milk not strained after each cow	2	2	2	
Can not in milkhouse during straining	2	1	1	
Water too low on cans	1	1	1	
Milk held over from previous day	1	..	..	
Empty icehouse	..	3	2	
Too short time allowed	..	1	..	
Total	27	23	18	20%
Cows—				
Garget	7	10	10	
Drying cows and milking once a day	2	9	4	
Milking machine injury	4	4	4	
Not stripped clean after machine	2	2	2	
Milked too soon after freshening	1	2	1	
Milked too close before freshening	..	1	1	
Udders not washed	2	2	2	
Wet hand milking	1	..	..	
Total	19	30	24	21%
Labor problems—				
Shifting of hired help	9	6	13	
Proprietor, inconsistent, lazy	4	3	5	
Learning how	2	..	..	
Sickness and lack of responsibility	1	1	2	
Total	16	10	20	13%
Miscellaneous—				
Building burned	..	1	..	
Stable small, contamination	1	2	1	
Total	1	3	1	2%
Not located	3	10	9	6%
Grand total	133	106	106	100%

The lack of a sufficient amount of boiling water and not allowing sufficient time to elapse for each piece of equipment to become thoroughly sterilized were recognized as the most common errors. As a typical case, high counts usually followed where one teakettle of boiling water was poured through the strainer into the pail, given a couple of whirls and emptied into the sink or into the other pails if there happened to be any. The whole operation seldom required more than a few seconds per piece of equipment. Also the water cooled down rapidly from the boiling point as it was emptied from one pail to the other. Even though the equipment had been carefully washed and the tin was scoured bright, it would not be sterilized sufficiently under these conditions to prevent serious bacterial growth and loss of Grade A premiums. Frequently where a milking machine was used, those in charge of the sterilizing were afraid of spoiling the rubber. However, the older the rubber, the more porous it becomes and the more likely it is to cause high counts. The dairymen using milking machines and having low counts not only did a thorough job of sterilizing but they planned on replacing the rubber parts coming into contact with the milk, at least every three months.

One man used a commercial chemical solution for sterilizing his pails and strainer and had very satisfactory results as long as he kept his equipment thoroughly washed and scoured. His troubles began just as soon as he permitted milk stone to collect in the pails. The chemical solution would not penetrate through the milk stone and kill the bacteria as would the heat from either boiling water or steam; consequently counts developed running into the hundreds of thousands.

The most successful Grade A producers put each piece of equipment into a tight-covered wash boiler or sterilizer which contained about two inches of water. The equipment was then boiled and steamed in this nearly air-tight container for at least three minutes after each milking. In using this type of sterilizer on the milking machine, the pails and the rubber, tubes and teat cups, one of large size was required and a wire rack was used so that the rubber did not come in contact with the bottom and thereby become overheated.

Milk cooling problems caused trouble for one-fifth of the producers with bacteria counts over 25,000, mostly from May to October. The fact that more cooling troubles were reported for September (as in sterilizing) than any other month reflected the general tendency to be short of ice at the end of the summer. The principal factor in the cooling problem was that the milk was not cooled below 50° F. soon after milking; especially the cooling of the milk after it reached 60° F. was too slow. Among the items that brought about this condition were: tank too small, lack of ice in tank, and ice put in tank at milking time instead of keeping tank iced between milking periods. The last of these conditions was found where non-insulated tanks were used. Those using insulated tanks had ice in the water continually, and often a piece of ice would not be entirely melted in three days' time, which meant that the temperature of the water was 37° F. or lower. Some did not strain the milk after milking each cow because it was too far to the milk house. Others set the can just outside the barn during milking instead of following the approved practice of putting the can into ice water and cooling the milk as soon as possible so as to stop bacterial growth. One producer found it necessary to rebuild his tank so as to raise the water level higher on the necks of the cans. He installed a new cork-insulated tank which required less ice and also corrected the trouble. In general, those who had

insulated cooling tanks used about 40 pounds of ice for every 100 pounds of milk cooled. Many times where non-insulated tanks were found, slow and unsatisfactory cooling took place even though twice as much ice was used per 100 pounds of milk.

Gargety milk from the cows contributed to 21 per cent of the producers' troubles. The cause of this was definitely traced to misuse of milking machines. It was most pronounced in those herds where a twin milking machine was in use. Also several of the men did not strip the cows out clean after using the machine. A number encountered high counts when drying off the cows and milking only once a day. Others milked too close to freshening or saved the milk too soon after freshening. Not washing the udders clean before milking was the reason given for a series of high counts by two dairymen, who blamed the situation on the hired men. Not only have many of these men corrected the above causes but they have learned the value of using a strip cup and checking the first streams drawn from each cow for signs of garget. In one instance, however, only the largest streams drawn showed such signs.

Although most of the high counts were due to previously named factors, some of the trouble could be attributed to the lack of human interest. When a new hired man started in, high counts were almost sure to follow. On the other hand, there were dairies where the proprietor was not a Grade A man. He knew how the work should be done, but his nature would not allow him to follow through consistently so as to produce quality milk regularly.

Only a few traced their high counts to stable conditions. In one instance the stable was so small and cramped that it was practically impossible to keep the cows clean and the milk from being contaminated.

In previously discussing the principal factors causing high counts and the distribution of the producers according to these factors, a producer was frequently counted under several headings. If these factors are to be evaluated on a bacteria count basis for each producer, it is necessary that they be combined. However, the producers with a single factor are kept separate wherever possible.

In Table 5, the principal factors and combinations are arrayed according to size of bacteria counts in five classes. In all, 1,697 counts ranging from 25,000 to 810,000 are allocated. Any one count appearing in Classes II to V inclusive would be high enough to prevent a producer from obtaining first premium during any one pay period.

The importance of thorough sterilizing to prevent high bacteria counts is again emphasized. Over 38 per cent of the total counts appear under this heading. When combinations are made of sterilizing and other factors, a larger percentage of the counts usually are found in the classes representing higher counts. The highest counts in the series resulted from a combination of lack of sterilizing, gargety milk, and slow cooling.

Wrong cooling method was the second most important single factor, closely followed by lax methods of hired men and lazy, inconsistent proprietors. The latter proved likely to land counts in any of the five classes and on the whole did not show up as well as the hired help.

Factors and Premium Losses

Carrying the analysis of this problem one step farther, what is the cost to Grade A producers in premiums lost for each of the above named factors or combinations? In answering this question the pay periods of each pro-

TABLE 5

Principal factors and methods causing high bacteria counts of Grade A producers and the distribution of these bacteria counts during the years 1931, 1932, 1933, according to five classes

Factors and combinations of factors causing high bacteria counts	I. 25,000 to 49,999 b. per ml.		II. 50,000 to 99,999 b. per ml.		III. 100,000 to 249,999 b. per ml.		IV. 250,000 to 499,999 b. per ml.		V. 500,000 b. per ml. over		Total	
	No. counts	Per cent	No. counts	Per cent	No. counts	Per cent	No. counts	Per cent	No. counts	Per cent	No. counts	Per cent
1. Improper sterilizing	387	59.0	187	28.5	59	9.0	9	1.4	14	2.1	656	38.7
2. Improper sterilizing and cooling	71	59.7	39	32.8	9	7.5	..	..	..	..	119	7.0
3. Improper sterilizing and not stripping after m.m.....	83	49.1	54	32.0	18	10.6	6	3.6	8	4.7	169	10.0
4. Improper sterilizing and dirty cows	35	50.7	27	39.2	5	7.3	1	1.4	1	1.4	69	4.1
5. Improper sterilizing and gargety milk	24	41.4	17	29.3	9	15.5	3	5.2	5	8.6	58	3.4
6. Improper sterilizing, dirty m. m., porous rubber, broken liners, and wooden plugs	80	77.7	18	17.5	3	2.9	1	1.0	1	1.1	103	6.1
7. Improper sterilizing, dirty can, broken seam.....	3	60.0	1	20.0	1	20.0	..	..	..	..	5	.3
8. Improper cooling, lack of ice, too slow.....	84	57.6	45	30.8	12	8.2	5	3.4	..	..	146	8.6
9. Improper cooling and holding milk over	5	45.5	6	54.5	..	...	..	..	..	..	11	.6
10. Gargety milk	45	59.2	18	23.7	10	13.2	2	2.6	1	1.3	76	4.5
11. Drying off cows, milking once a day.....	27	71.1	8	21.0	2	5.3	1	2.6	..	..	38	2.2
12. Cows milked too close to freshening	7	70.0	3	30.0	..	...	..	..	..	..	10	.6
13. Cows milked to soon after freshening	4	57.1	...	...	2	28.6	1	14.3	..	..	7	.4
14. Cows dirty, udders not washed	2	66.7	1	33.3	..	...	..	..	..	..	3	.2
15. Hired help, lax methods....	92	67.6	31	22.8	10	7.4	1	.7	2	1.5	136	8.0
16. Proprietor inconsistent, lazy	42	66.7	11	17.5	5	7.9	2	3.2	3	4.7	63	3.7
17. Could not locate trouble....	17	60.7	10	35.7	1	3.6	..	..	..	..	28	1.6
Total counts	1008		476		146		32		35		1697	
Distribution of counts.....	59%		28%		9%		2%		2%		100%	

ducer were carefully reviewed to determine whether or not any of the high counts previously discussed actually did cause him to take second or third premiums or no premiums at all. The amount over what first premiums would have been and what he received in second or third premiums or no premiums at all would be the amount of lost premiums. This amount varied directly with the volume of milk shipped during a pay period and the rate paid. As was previously pointed out, more high counts occurred during the summer and early fall months when the highest rates were in effect.

In the preceding discussion of Table 5 the counts could be considered separately for many single factors, but it is necessary to combine these factors still more when considering pay periods and premiums. The bacteria counts are based on four samples of milk taken for each producer during a pay period; accordingly, the chances of having more factors in one period are greatly increased. Furthermore, many encountered a variety of troubles during the three-year period. This explains why new combinations were necessary in determining the lost premium for each producer. (See Table 6.)

The most important single factors in total lost premiums for the entire three-year period are in the following order: sterilizing, $1,542.18; cooling, $331.74; and gargety milk, $290.86. On a combination basis, sterilizing, unreliable hired help and milking too soon after freshening were the most costly, amounting to $1,380.22; sterilizing and not stripping after the milking machine, totalling $949.35, second; and sterilizing, dirty milking machine, porous rubber, and wooden plugs made the third largest lost premium item, totalling $520.49.

Comparing the factors on a yearly basis, considerable improvement was made in sterilizing methods between the years 1931 and 1933. Whereas 20 producers lost premiums in 1931, totalling $659.50, only 13 lost premiums because of poor sterilizing in 1933, amounting to $358.46. The average of premiums lost on this account showed much improvement between 1931 and 1933. However, some producers learn very slowly. One large shipper lost $121.24 in 1931, $213.57 in 1932, and $164.29 in 1933, or a total of $499.10 during the three-year period, because his equipment was not sterilized.

About the same yearly losses occurred for cooling. There was little change in the number of men who lost premiums, but there was a downward trend in the average amount lost. The largest amounts lost by any one producer due to this factor were $67.69 in 1931, $61.70 in 1932, and $43.87 in 1933, or a total of $173.26 in the three-year period. His losses would have built several well insulated cooling tanks.

Gargety milk caused producers more trouble and bigger premium losses, both average and total, with each succeeding year. The largest amounts lost by one producer for this cause were $30.63 in 1932, and $59.65 in 1933. Another lost $38.73 in 1932, and $35.80 in 1933.

About the same situation was found in respect to drying off cows, milking once a day, milking too close to the freshening period or too soon after. Since all of these factors are so closely allied with gargety milk, particularly in the producer's mind, they could be considered as one group. On this basis the total premium losses for each year would increase from $33.79 in 1931 to $160.11 in 1932 and to $232.81 in 1933. Apparently these conditions need to be guarded against more carefully, for 26 producers in the combined group experienced trouble with them in 1933.

Comparing the most important combinations of factors on a yearly basis, a marked improvement was made by those who had not sterilized properly,

TABLE 6

Amount of lost premiums according to principal factors

Principal factors and combinations	1931			1932			1933			Total Lost premium	
	No. prod.	Lost premium Total	Lost premium Average	No. prod.	Lost premium Total	Lost premium Average	No. prod.	Lost premium Total	Lost premium Average	Total	Av. per producer per year
		(dollars)	(dollars)		(dollars)	(dollars)		(dollars)	(dollars)	(dollars)	(dollars)
1. Improper sterilizing	20	659.50	32.98	20	524.22	26.21	13	358.46	27.57	1,542.18	29.10
2. Improper sterilizing and cooling	4	130.04	32.51	1	8.70	8.70	1	12.36	12.36	151.10	25.18
3. Improper sterilizing and not stripping after milking machine	2	233.06	116.53	2	267.01	133.50	2	499.28	249.64	949.35	158.22
4. Improper sterilizing and dirty cows	..	.....	.....	1	5.85	5.85	1	13.71	13.71	19.56	9.78
5. Improper sterilizing and gargety milk	1	56.64	56.64	..	.....	.....	..	.....	.....	56.64	56.64
6. Improper sterilizing, dirty milking machine, porous rubber, wooden plugs	4	225.76	56.44	4	156.98	39.24	3	137.75	45.92	520.49	47.32
7. Improper sterilizing, dirty can, broken seam	..	.....	.....	1	1.49	1.49	1	4.07	4.07	5.56	2.78
4 and 16. Improper sterilizing, dirty cows, proprietor inconsistent, lazy	1	140.11	140.11	1	37.29	37.29	..	.....	.....	177.40	88.70
1, 13, 15. Improper sterilizing, cows milked too soon after freshening, hired help	5	707.12	141.42	6	399.29	66.55	6	273.81	45.64	1,380.22	81.19
5 and 8. Improper sterilizing, cooling, and dirty cows	..	.....	.....	1	62.47	62.47	1	22.39	22.39	84.86	42.43
8. Improper cooling	7	109.13	15.59	9	122.19	13.58	9	100.42	11.16	331.74	13.27
9. Improper cooling and holding milk over	1	2.45	2.45	..	.....	.....	..	.....	.....	2.45	2.45
9, 14, 15. Improper cooling, dirty cows, hired help	2	34.53	17.26	1	29.69	29.69	1	36.47	36.47	100.69	25.17
10. Gargety milk	1	31.36	31.36	6	97.77	16.30	4	161.73	40.43	290.86	26.44
11. Drying off cows, milking once a day	..	.....	.....	6	47.96	7.99	3	33.36	11.12	81.32	9.04
10 and 11. Gargety milk and milking once a day	..	.....	.....	1	6.73	6.73	1	4.30	4.30	11.03	5.52
12. Cows milked too close to freshening	..	.....	.....	1	7.65	7.65	1	12.07	12.07	19.72	9.86
13. Cows milked too soon after freshening	1	2.43	2.43	..	.....	.....	1	21.35	21.35	23.78	11.89
14. Cows dirty, udders not washed	1	14.97	14.97	1	7.86	7.86	1	9.76	9.76	32.59	10.86
15. Hired help and lax methods	2	111.66	55.83	2	23.20	11.60	6	71.88	11.98	206.74	20.67
16. Proprietor inconsistent, lazy	1	42.55	42.55	1	65.86	65.86	3	113.25	37.75	221.66	44.33
15 and 16. Hired help and lazy proprietor	1	32.03	32.03	1	15.86	15.86	1	18.92	18.92	66.81	22.27
17. Could not locate trouble	1	7.88	7.88	6	38.14	6.36	6	21.59	3.60	67.61	5.20
Total	55	2,541.22	46.20	72	1,926.21	26.75	65	1,876.93	28.88	6,344.36	33.04
Premiums actually paid Grade A producers		18,478.50			19,199.23			13,780.56		51,458.29	
Grand total		21,019.72			21,125.44			15,657.49		57,802.65	
Premiums lost of grand total		12.1%			9.1%			12.0%		11.0%	

who had milked too soon after freshening and had experienced trouble with the hired help. In 1931, five of them lost $707.12; in 1932, six lost $399.29; and in 1933, six lost $273.81. The same was true of those producers who in addition to not sterilizing, had dirty milking machines, porous rubber and used wooden plugs in old-fashioned eight-quart cans when cooling the milk. Their losses dropped from $225.76 in 1931 to $156.98 in 1932, and to $137.75 in 1933. However, one man in the group managed to lose about the same amount each year. His losses were $85.79 in 1931, $100.43 in 1932, and $92.88 in 1933. His principal sin was poor sterilizing and old rubber on the milking machine.

The two producers who had trouble in sterilizing equipment and who persisted in not stripping the udders clean after using the milking machine lost $233.06 in 1931, $267.01 in 1932, and $499.28 in 1933. One reason for their high losses was the large volume of milk shipped.

Totalling the last premium in each year for all factors given in Table 6 shows that $2,541.22 was lost in 1931, $1,926.31 in 1932, and $1,876.93 in 1933. On a percentage basis, the premiums lost in 1931 were 12.1 per cent of the grand total; 9.1 per cent in 1932, and 12.0 per cent in 1933. Without doubt if the study had been continued through the years 1934 and 1935, it would show a smaller percentage of lost premiums during these years, because recent reports show this station had advanced farther in the quality program.

Differences between Grade A and B producers: In order to determine the fundamental differences between the A and B milk producers it was necessary to compare them in a detailed way regarding the stable, the milkhouse, the type of equipment, general condition and method of caring for the equipment, handling the milk and the labor and current costs involved. Although many B producers had identically the same equipment and were caring for the milk in about the same way as the A producers, this analysis brought to light a number of practices in which they differed. These general differences indicate what the B producers would have to do in order to equal the Grade A standard if they were to produce milk averaging under 10,000.

Some of the B producers in both the Pattee and Monroe areas were in the Grade A class. They appreciated the fact that they were handling a highly perishable food product and they performed conscientiously each operation which would insure its quality. In the Pattee area many of the Grade B producers were anxious to be taken on as Grade A, if the opportunity developed. A few of the B producers in the Monroe area had shipped Grade A milk in the past. Several of them stated that they were following the same procedure in producing B milk that they had used in producing the Grade A milk. However, the comparison of the two groups of B producers on the volume of milk shipped showed that those in Monroe shipped much larger quantities daily than those at Pattee. For this reason they had more to do with, and their stables and milkhouses were generally better equipped than those of the B producers at Pattee. During the year 1933, the 79 Grade A producers had 1189 cows, the 17 Grade B producers at Pattee had 243, and the 24 Grade B producers in Monroe had 507.

Stable: In many instances the cows were kept in the stable over night during the summer because there was not a night pasture close to the barn. This practice required more labor in keeping the cows and stable clean.

There was no marked difference between the A and B producers in the number of times the stable was cleaned during the summer months. During the winter months the Grade A producers cleaned the stable on an average of three times daily, compared with two times daily for the B producers at Pattee and three times for the B producers in Monroe. On a per cow basis the time spent in cleaning the stable daily by the Grade A producers averaged a little higher during the winter and summer months than either of the Grade B groups. The amount of sawdust used for bedding per cow in a month's time by the Grade A producers was almost identical with the B producers at Pattee, but about 40 per cent greater than the B producers in Monroe. (See Table 7.)

Milkhouse: Practically no important differences were noted between the A and B producers so far as the milkhouse was concerned. Nearly all had good drainage. The B producers were more careless in preventing dust accumulations in and around the milkhouse and in screening out the flies than were the A producers. More B producers in Monroe washed and cleaned the floors daily than did either the A or B producers at Pattee. One reason for this was that 87 per cent of them had running water available in the milkhouse compared with 49 per cent of the Grade A producers.

The Grade A dairymen who were cooling the milk with ice entirely used it an average of 191 days compared with 175 days for the Grade B dairymen at Pattee and with 136 days for those in Monroe. One B producer in Monroe used up his entire ice supply in two months' time. This man claimed he spent about three hours daily during the winter months in grooming the cows. He might better have used most of this time in cutting and putting up ice so as to have a sufficient supply for the entire summer season. When the three groups are compared as to the pounds of ice used per cwt. of milk, there is no apparent difference; but the longer period of using ice by the Grade A dairymen over the B dairymen in Monroe represents an additional cost in caring for Grade A over Grade B milk. On this basis the 66 Grade A dairymen would use over 364 tons of ice more than the B dairymen in Monroe in cooling the same amount of milk per season. If this extra amount of ice is figured at $6.50 per ton (the price at which ice was sold and delivered), the cost would be $2,366 or 9.3 cents per cwt. for all milk cooled in the summer season. (See Table 7.)

Current Expense: All Grade A dairymen are supposed to use a small top pail when milking by hand. Of the group considered in this analysis, only 8 or 10 per cent of them did not have a small top pail as part of their equipment; 47 per cent of the B producers at Pattee and 70 per cent of the B producers at Monroe did not use small top pails.

When the replacements of rubber for milking machines were compared, the Grade A producers were found to have about twice as much expense for rubber inflations, as they changed them on an average of every 3.7 months compared with over seven months for the B producers. The short and long rubbers on the machines of the Grade A producers were changed about every eight months, or approximately two to four times as often as those of the B producers. Inflations usually cost 75 cents each, and a set of short and long rubbers about $2.50. On this basis the approximate cost of rubber for a single unit machine of a Grade A producer would be $13.35 yearly, $6.05 for the B producer at Pattee, and $6.52 for the B producer in Monroe. (See Table 7.)

Table 7

Differences between Grade A and B Producers according to various factors

Comparative items	Grade A		Grade B, Pattee		Grade B, Monroe	
	No. producers	Ave. amt. per producer	No. producers	Ave. amt. per producer	No. producers	Ave. amt. per producer
Ave. bush. sawdust per cow, one winter month	77	10	16	10	17	6
Ave. bush. sawdust per cow, one summer month	71	5	12	4	11	3
Ave. no. min. cleaning stable daily per cow—winter	79	4.07	17	3.97	24	3.62
Ave. no. min. cleaning stable daily per cow—summer	78	1.73	17	1.65	24	1.46
Ave. no. days cooling with ice	66	191	13	175	8	136
Ave. no. months rubber inflations for milking machine are used	7	3.7	2	7.5	9	7.0
Ave. no. months short rubber tubes used	7	8.0	2	18.0	9	21.4
Ave. no. months long rubber tubes used	7	8.3	2	33.0	9	22.7

Caring for the cows and milking practices: Nearly all of the items shown in Table 8 do not involve any great amount of expense or time; but they are considered important by the Grade A producers in maintaining a high standard of quality. The clipping of the long hair on flanks and udders enables them to keep the cow clean more easily and to prevent sediment from falling into the milk pail. On a percentage basis about twice as many Grade A producers as the B producers in Monroe were following this practice. They make it almost a unanimous practice to wipe the udders clean before milking, and 73 per cent of them used a damp cloth for this purpose. Only 16.7 per cent of the B producers in Monroe wiped the cows' udders clean before milking, and the greater portion of these used a dry cloth. However, they stated the cows were washed when necessary. It requires from 10 to 15 seconds on the average to wipe the udder clean.

The first streams are discarded by 88.6 per cent of the Grade A producers, by 70 per cent of the B producers at Pattee, and only by 29.2 per cent of the B producers at Monroe. Eighteen of the A producers test the first streams of each cow with a strip cup and examine it carefully for flecks of garget. This is not done by any of the B producers in either group. The cost of a strip cup is about $1.25.

The importance of cooling the milk as soon as possible is realized by the Grade A men; for over 78 per cent of them strain it after each cow and 26.6 per cent of them place the can in the ice water before straining the milk into the can. Over one-third of the B producers in Monroe placed the can handy in the stable or in a room near the stable during milking time, and only 8.3 per cent of them placed the can in the ice water.

The jarring of the strainer is perhaps the one worst habit of B producers Even seven of the A producers persisted in jarring the strainer on the milk can so as to hurry the passage of the milk through the strainer and pad. One dairyman said he had given up trying to prevent this bad habit, but he had remedied the danger of breaking the pad and of getting sediment in the milk can by using two thicknesses of pads on the strainer at one time. Some of the quantity milk producers have added an extra strainer to their equipment to save time.

Washing and sterilizing: The Grade A producers outclassed the B producers in Monroe on nearly all counts in washing and sterilizing the equipment. (See Table 9.) The B producers in Monroe washed and sterilized the equipment after the morning milking, but over half of them neglected to sterilize the equipment after the night milking. The group of B producers at Pattee were following more nearly the common practices of the Grade A producers.

There was very little difference between the Grade A producers and the Grade B producers in Monroe in respect to using an alkali washing powder. About half of them used it regularly in the washing water. On the other hand, over 88 per cent of the B producers at Pattee were using soap or soap flakes when washing the equipment. The use of soap tends to increase milk stone deposits on the surface of the equipment, whereas an alkali powder will destroy it. Therefore, those using soap scoured the equipment more frequently. It was impossible to obtain accurate information as to the cost of powder or soap used yearly because it was part of the regular household supplies. Those producing Grade A milk scoured the equipment on an average of every 11 days, whereas the B producers at Pattee found it neces-

Table 8

Differences between Grade A and B producers in caring for the cows and in milking practices

Comparative items	Grade A producers		Grade B producers, Pattee		Grade B producers, Monroe	
	No.	Per cent	No.	Per cent	No.	Per cent
Hair clipped on flanks—winter months	36	45.6	8	47.0	6	25.0
Hair clipped on udders—winter months	40	50.6	9	53.0	5	20.8
Udders wiped before milking	76	96.2	15	88.2	4	16.7
Udders wiped with a damp cloth	58	73.4	11	64.7	1	4.2
Udders wiped with a dry cloth	18	22.8	4	23.5	3	12.5
Warm water used in washing udders	43	54.4	5	29.4	1	4.2
Washing water changed	26	32.9	2	11.8	1	4.2
First streams discarded	70	88.6	12	70.0	7	29.2
Used strip cup	18	22.8	..	...	..	...
Milk strained after each cow	62	78.5	12	70.6	16	66.7
Milk can placed in:						
Milkhouse	77	97.5	15	88.2	16	66.7
Cooling tank	21	26.6	4	23.5	2	8.3
Stable behind cows	1	1.3	1	5.9	5	20.8
Room near stable	1	1.3	1	5.9	3	12.5
Dusty location	4	5.1	1	5.9	3	12.5
Strainer pounded	7	8.9	4	23.5	11	45.8

sary to scour on an average of every six days, principally because over 88 per cent of them were using soap in the washing water.

In sterilizing the equipment the Grade A dairymen, with few exceptions, used boiling water before each milking period. The exceptions were one who used steam regularly and two who used a chemical solution. Of the Grade B producers in Monroe, 10 sterilized with boiling water after the night milking, 23 after the morning milking, and one used a chemical solution once a day.

Only two Grade B producers used boiling water in a container with a tight cover on the stove when sterilizing the equipment. The others used a dishpan or the pails in the sink and poured the boiling water over the equipment. Over 27 per cent of the Grade A producers boiled the equipment in a container on the stove.* The others followed the practice of pouring the boiling water over the equipment in the sink.

The amount of boiling water used in sterilizing was almost identical for the Grade A producers morning and evening. It was slightly less for the B producers at Pattee in the evening; but about one-third as much boiling water was used in sterilizing at night by the Grade B producers in Monroe. (See Table 10.)

There was very little difference in the amount of boiling water used per piece of equipment by any producer in the three groups.

A decided difference was found between the average time that a pail or strainer was kept in the boiling water. The pails and strainers of the Grade A producers were kept in the boiling water an average of 2.4 minutes at night and 2.5 minutes in the morning; those of the Grade B producers at Pattee 1.5 minutes night and morning, and those of the Grade B producers at Monroe were given a "ducking" lasting from 6 to 12 seconds. The milking machine pails and rubber fared a trifle better.

The total time utilized by the producers in all three groups in washing and sterilizing the equipment night and morning was in about the same proportion as the amount of water used; that is, the Grade A and B producers at Pattee used the same amount of time morning and evening because they were doing almost identically the same job. The B producers at Monroe got through the job in one-fourth the time at night as in the morning.

It is impossible to place an accurate figure on the value of the time used by the Grade A men, and not used by the Grade B men. One thing is certain: none of the Grade A men would recommend using less boiling water or doing the job in less time. A loss in premiums would follow immediately.

In analyzing the essential differences between Grade A and Grade B dairymen, we find certain practices which are followed regularly, morning and evening, in the care of Grade A milk which are not followed regularly in the care of Grade B milk. There are extra costs for ice and also for equipment, but when these costs are compared with the total premiums paid they are of little importance. Extra time is the principal factor of cost in caring for Grade A milk; more time is used in washing and sterilizing the equipment and in washing the udders. As a class the Grade A dairymen have developed a higher standard of technique. They give everlasting attention to the details which are necessary if they are to receive first premiums.

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* At the date of this writing, January 7, 1936, the per cent of Grade A dairymen at Pattee using containers with tight fitting covers and boiling water on the stove when sterilizing the equipment had increased to about 78.

Table 9

Differences between Grade A and B producers in washing and sterilizing the equipment

Comparative items		Grade A		Grade B, Pattee		Grade B, Monroe	
		No.	Per cent	No.	Per cent	No.	Per cent
Equipment washed in hot water	P.M.	69	87.3	17	100.0	9	37.5
	A.M.	67	84.8	17	100.0	20	83.3
Use powder, oakite, wyandotte, soda, etc., in washing		38	48.1	3	17.6	11	45.8
Use soap or soap flakes in washing		29	36.7	14	82.4	11	45.8
Do not use either powder or soap in washing		12	15.2	..	....	2	8.4
Use boiling water in sterilizing equipment	P.M.	76	96.2	15	88.2	10	41.7
	A.M.	77	97.5	16	94.1	23	95.8
Use boiling water in container with tight cover on stove	P.M.	14	17.7	..	....	..	...
	A.M.	14	17.7	1	5.9	1	4.2
Use boiling water in open container on stove	P.M.	8	10.1	..	....	..	...
	A.M.	9	11.4	1	5.9	..	...
Use dishpan in sink	P.M.	26	32.9	11	64.7	2	8.3
	A.M.	26	32.9	10	58.8	5	20.8
Use pails in sink	P.M.	30	38.0	4	23.5	7	29.2
	A.M.	29	36.7	4	23.5	16	66.7

Table 10

Differences between Grade A and B producers in amount of boiling water used and time in sterilizing equipment

Comparative items		Grade A		Grade B, Pattee		Grade A, Monroe	
		No. producers	Amt. or no.	No. producers	Amt. or no.	No. producers	Amt. or no.
Total qts. boiling water used, all producers	P.M.	76	712	15	111	10	64
	A.M.	77	714	16	139	23	185
Ave. qts. boiling water per piece of equipment	P.M.	65	7.6	12	5.5	4	6.2
	A.M.	66	7.7	13	6.9	17	6.4
Ave. sterilizing time per pail and strainer (minutes)	P.M.	65	2.4	12	1.1	4	.1
	A.M.	66	2.5	13	1.1	17	.2
Ave. sterilizing time per milking machine and rubber (minutes)	P.M.	11	6.3	3	1.5	6	.2
	A.M.	11	5.2	3	1.5	6	.5
Total time washing and sterilizing equipment (minutes)	P.M.	76	1305	15	240	10	170
	A.M.	77	1396	16	251	23	606

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